RT-161: Enterprise Systems Analysis

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Research Task / Overview

Many of the challenges that confront the Department of Defense (DoD) are characterized by the intersection of complex social, political, economic, and technical phenomena where conventional modeling techniques are inadequate. Human and organizational effects can dominate technical outcomes. For example:

- Combating the proliferation of counterfeit parts in military systems
- Managing joint and international acquisition programs
- Coordinating disaster and humanitarian responses involving governments, NGOs, and US agencies
- Sustaining the defense supplier base in the face of declining acquisition quantities

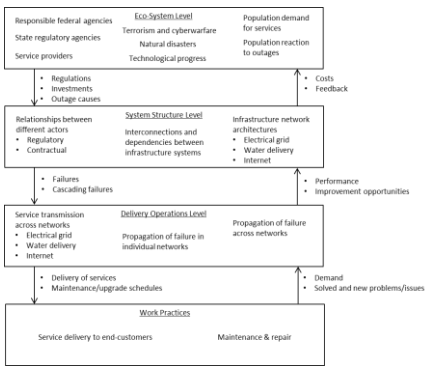
This task is creating systems-oriented modeling methodologies to study and assist policy formulation for such enterprise problems, along with case study demonstrations and validations.

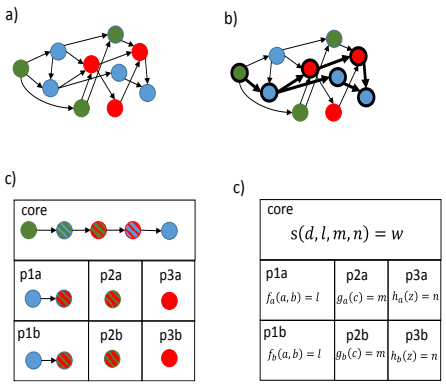
Data & Analysis

Critical Infrastructure Protection Model: What is the best mix of investments, standards and policies for providing long-term value in terms of availability, safety and security versus cost?

Applied an enterprise view:

- Expands scope beyond the physical infrastructure to include organizational and social factors
- Results in a multi-level view of the enterprise system



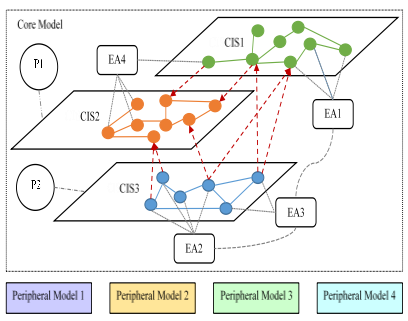


Applied the core-peripheral approach:

- The core model captures factors that drive steady state behaviors
- Interchangeable peripheral models capture disruptive factors

Created a model architecture:

- Core model integrates infrastructure systems, interconnections, enterprise actors and policy actors
- Peripheral models represent terrorism or a natural disaster



Revised and expanded the modeling methodology based on findings:

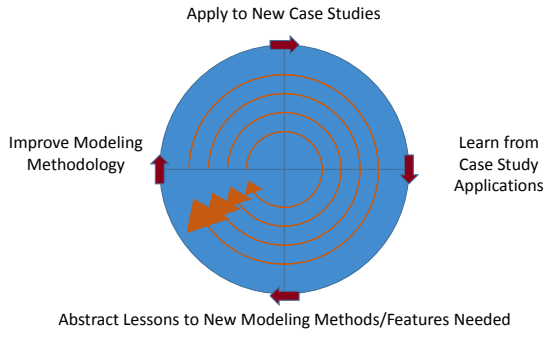
- Three-phased approach:
  1. Identify, Model, and Validate the Core Relationships
  2. Introduce and Model Peripheral Relationships to Generate Scenarios
  3. Communicate with Stakeholders via Interactive Interface and Visualizations
- Each phase contains a number of detailed steps that provide additional guidance to enterprise analysts
- Added role definitions and recommended participants for each step of the methodology

Goals & Objectives

The outcome of the previous RT-138 study was a shift in emphasis away from building a unitary enterprise model toward a core-peripheral approach in which "peripheral" models could be added or removed as needed to generate scenarios of interest to enterprise stakeholders. Peer reviews indicated the need to detect unintended or counter-intuitive policy consequences and to deal with multi-scale ontologies. The major tasks for RT-161 were:

- Apply the core-peripheral approach to a case study of protecting critical infrastructure
- Develop and validate counter-intuitive results, secondary effects, and policy tipping points
- Extended canonical phenomena and model reuse methods to include multi-scale ontologies
- Update the enterprise analysis methods to incorporate the results of the other tasks

Methodology



- Develop methodologies for modeling enterprises
- Iterate with case studies to test, validate and improve the methodology
- First spiral started with a ten-step methodology and applied it to counterfeit parts detection and avoidance
- A series of peer-reviews were used to evaluate the methodology and suggest improvements
- Second spiral applied a modified version of the ten-step methodology to critical infrastructure protection
- Lessons learned were used to revise the methodology
- Revised methodology will be evaluated using new cases

Future Research

- Evaluate revised methodology using new case studies in the healthcare domain
- Develop a rigorous approach to partitioning and refactoring models for reuse
- Adapt the concept of a "nomological network" from the social sciences to the organization of candidate models for use in an enterprise analysis
- Directly integrate uncertainty quantification approaches into the enterprise modeling methodology

Contacts/References

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